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## (54) Device for emergency operation of an elevator motor

(57) Device (100) for rotating an elevator motor during an emergency situation, such as a power failure, comprising a d.c. supply (4) and a rotary switch (8) used as a switching device for supplying a d.c. voltage into the windings (R-S, R-T, S-T) of the elevator motor (1). The d.c. voltage (DCC+, DCC-) controlled by the rotary

switch is fed by turns into each winding (R-S, R-T, S-T). In addition, the device comprises a switch (6) used to supply a voltage to the brake (3) and to short-circuit the windings.

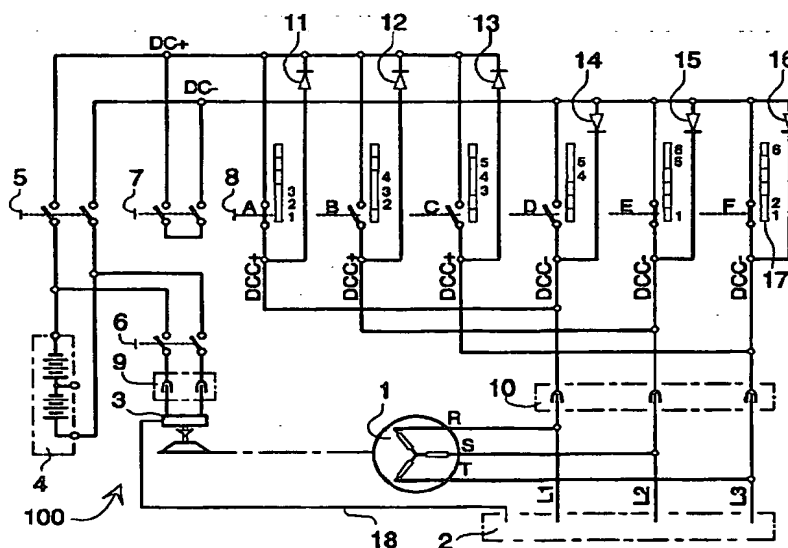


Fig. 1

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## Description

The present invention relates to a device as defined in the preamble of claim 1 for operating an elevator motor in an emergency, such as a power failure.

According to elevator regulations, when an elevator stops between landings, there must be a possibility to move the elevator car to a suitable landing. For this purpose, several methods are used, such as releasing the brake manually using a suitable tool. If the position and load of the elevator are such that the elevator can start moving, then releasing the brake is an applicable method. If the elevator and its counterweight are in equilibrium, it is additionally necessary to rotate the elevator motor by some means.

At present, battery-operated inverters are used for this purpose. However, they are expensive and more susceptible to malfunctions than manual methods. Specification US 4,376, 471 presents a method involving the use of an inverter in an emergency. However, it does not solve the problem of the elevator being stopped due to a disturbance occurring in the inverter itself.

There are also elevator machines implemented using a synchronous motor with permanent magnets, such as e.g. the one presented in specification PCT/FI94/00285.

The object of the present invention is to produce a simple and cheap solution whereby an elevator car driven by an elevator motor provided with permanent magnets can be moved in an emergency, especially in a situation where the elevator car is in a state of equilibrium and cannot be set in motion by the gravitational force.

To achieve the objectives stated above, the device of the invention is characterized by what is said in the characterization part of claim 1. Other embodiments of the invention are characterized by the features presented in the other claims.

The battery operated device for emergency operation of an elevator motor is very advantageous in respect of price. It uses a small battery, and the devices used to switch current to the elevator motor, such as switches and diodes, typically have current ratings of only about 5 - 10 A and are therefore cheap. Even together with a d.c. supply, the emergency operation device of the invention is so small and light that an elevator installer can easily carry it along.

In the following, the invention is described by the aid of an embodiment, in which

Fig. 1 presents the circuit diagram of an embodiment of the device of the invention, and

Fig. 2 presents the device of the invention implemented using simple electronics.

Fig. 1 presents the circuit diagram of a circuit arrangement for the device 100 of the invention. In nor-

mal operation, the elevator motor 1, e.g. a synchronous motor with permanent magnets, receives its three-phase operating voltage L1-L2-L3, and the brake 3 its operating voltage 18, through the elevator drive 2. In the event of an emergency, e.g. when the elevator stops between landings, the voltages DC+/DC- of the d.c. supply 4 are fed as d.c. voltages DCC+ and DCC- under control of a rotary switch 8 alternately into each one of the windings R-S, R-T and S-T of the elevator motor. The d.c. supply is preferably an accumulator or battery.

The rotary switch has six contacts, A, B, C, D, E and F. The full 360° rotation angle of the rotary switch is divided into six parts, i.e. one step of the rotary switch corresponds to 60 degrees. Each contact A...F is closed during three successive 60-degree steps. 'Rotary switch' means that the switch can be rotated continuously in both directions, repeating the same switching function during each revolution. The bar 17 depicted beside the switch describes the closed states of the switching functions A - F, the black numbered area representing the steps during which the switch is closed. Alternatively, the rotary switch may have a number of contacts A...F equalling a multiple of six, in which case the operating interval for each contact would be equal to the angle of a full revolution, three hundred and sixty (360) degrees, divided by the same multiple of six.

The d.c. supply voltages DC+ and DC- are passed via a double-pole switch 5 to the six contacts of the rotary switch, DC+ being applied to contacts A-C and DC- to contacts D-F. The contacts are connected in pairs A-D, C-E and D-F on one side, and the d.c. voltage DCC+/DCC- controlled by the rotary switch is further passed to the elevator motor 1 via a three-phase plug 10. Connected across each contact A-C is one of the commutating diodes 11-13 with DC+ as their discharge direction, and similarly, across contacts D-F there is connected one of the commutating diodes 14-16 with DC- as their discharge direction. Through the commutating diodes, the inductance energy returning from a winding of the elevator motor 1 is discharged into another winding.

To release the brake 3, the brake is fed with a d.c. voltage from the d.c. supply 4, controlled by switch 6.

In addition, the circuit is provided with a shorting switch 7, by means of which the d.c. terminals DC+ and DC- on the input side of the rotary switch 8 can be short-circuited when they are not carrying a voltage. Alternatively, the windings could naturally be shorted directly at the terminals R-S-T of the elevator motor.

To rotate the elevator motor 1 in the up or down direction in an emergency, the following procedure is applied:

The main switch 5 of the d.c. supply is closed to supply a voltage to the rotary switch 8 and the brake is released by closing switch 6. Via three rotary switch contacts, a positive voltage is now connected to one of the elevator motor windings and a negative voltage to the other two windings, depending on the position of the rotary switch. The magnetic field of the elevator motor

turns through 60 electric degrees and the shaft of the elevator motor jerks into another position. By turning the rotary switch to the next position, the voltages supplied to the windings are changed and the magnetic field is turned by another 60 degrees for each step. This process is carried on until the elevator reaches the nearest landing, at which time the brake is closed and the d.c. supply main switch 5 can be opened. In practice, the elevator moves through a distance of a few centimetres for each step of the rotary switch, e.g. from position A → B. When the rotary switch is in the position shown in Fig. 1, it passes the positive voltage via contact A to winding terminal R of the elevator motor 1 and the negative voltage to windings S and T via contacts E and F.

In this connection it may be noted that supplying a d.c. voltage into the motor windings to brake the motor is known in itself, but that is not the purpose of the present invention, but to rotate the elevator motor slowly in steps using a d.c. current especially in motor load situations where the elevator and its counterweight are in a state of equilibrium and releasing the brake will not set the elevator in motion.

When under supervision, the device 100 of the invention for emergency operation of an elevator can also be left in a state in which the main switch 5 is open, the brake switch 6 is closed (the brake being released) and the shorting switch 7 also closed. When the elevator starts to move e.g. due to gravity, an electromotive force is set up in the shortcircuited windings of the elevator motor, developing a torque in the motor, and the elevator is able to descend or ascend in a controlled manner, the direction of motion being determined by the elevator load.

Fig. 2 presents another embodiment of the device 101 of the invention, implemented using solid state switches. Each contact A-F of the rotary switch 8 has been replaced with a solid state switch 20 and their control unit 21. The output of the circuit gives the same controlled d.c. voltages DCC+/DCC- to the elevator motor as in the embodiment in Fig. 1. In this case, the desired up/down direction of motion is controlled by switches 22 and 23, corresponding to the direction of rotation of the rotary switch. The circuit comprises a speed setting device 24, preferably a potentiometer, corresponding to the speed of rotation of the rotary switch. Switch 26 serves to release the brake 3. The function of the device 101 is the same as with the device 100 in Fig. 1, i.e. the d.c. voltage fed into the elevator motor is stepped from winding to winding, causing the elevator motor 1 to rotate in jerks. This embodiment, too, is advantageous in respect of price and can easily be carried by an elevator installer.

It is obvious to a person skilled in the art that the embodiments of the invention are not restricted to the examples described above, but that they may instead be varied in the scope of the following claims.

## Claims

1. Device for rotating an elevator motor (1) to move the elevator in the up or down direction during an emergency situation, such as a power failure, said device comprising a d.c. supply (4) and switching devices for feeding a d.c. voltage from the d.c. supply (4) into the windings (R-S, R-T, S-T) of the elevator motor (1) and an actuator for releasing the brake (3), characterized in that the switching device for feeding the d.c. voltage (DCC+, DCC-) into the windings of the elevator motor (1) is a switch, preferably a rotary switch (8), by means of which the d.c. voltage (DC+, DC-) of the d.c. supply (4) is fed by turns into each winding (R-S, R-T, S-T).
2. Device (100, 101) according to claim 1, characterized in that the rotary switch (8) has six contacts (A...F) or a number of contacts equal to a multiple of six and that the operating interval of the contacts (A...F) of the rotary switch is the angle of a full revolution, three hundred and sixty (360) degrees, divided by six or a multiple of six.
3. Device (100, 101) according to claim 2, characterized in that, when the elevator motor (1) is to be rotated in the up direction of the elevator, the rotary switch (8) is rotated in one direction, and when the elevator motor (1) is to be rotated in the down direction, the rotary switch (8) is rotated in the other direction.
4. Device (100, 101) according to claim 2, characterized in that it is provided with commutating diodes (11...16), one commutating diode (11...16) being connected in parallel with each one of the contacts (A...F) of the rotary switch (8), said commutating diodes serving to discharge the inductance energy of the windings (R-S, R-T, S-T) of the elevator motor (1) into another winding (R-S, R-T, S-T).
5. Device (100, 101) according to any one of claims 1 - 4, characterized in that, to enable the brake (3) to be released, the device is provided with a switch (6) by means of which the brake (3) is fed with a voltage from the d.c. supply (4).
6. Device (100, 101) according to any one of claims 3 - 5, characterized in that the device (100, 101) is provided with a short-circuiting switch (7) by means of which the windings (R-S, R-T, S-T) of the elevator motor (1) can be shortcircuited either by shorting the d.c. terminals (DC+, DC-) supplying the rotary switch (8) when no voltage is connected to said terminals or by shorting the terminals (R, S, T) of the elevator motor windings directly.
7. Device (100, 101) according to any one of claims 1 - 6, characterized in that each contact (A...F) of the

rotary switch (8) has been replaced with a solid state switch (20) and a unit (21) controlling the solid state switches, that the direction of rotation of the elevator motor is controlled by one switch (22) in one direction and by another switch (23) in the other direction, and that the speed of rotation of the elevator motor is controlled by means of a setting device (24), preferably a potentiometer.

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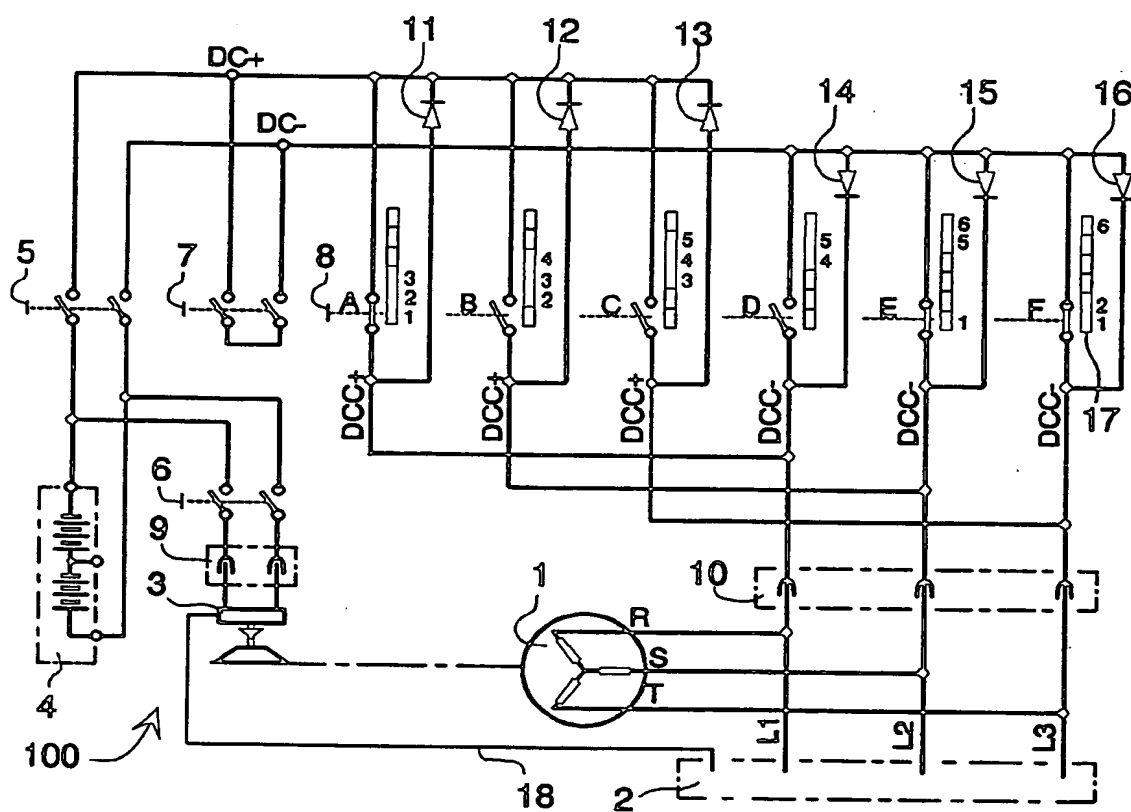


Fig. 1

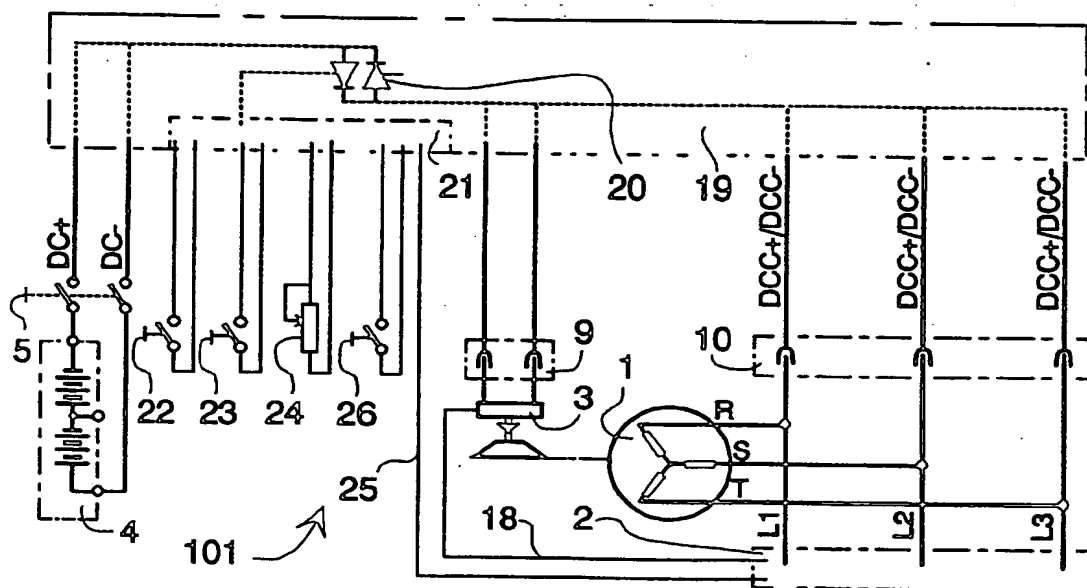


Fig. 2

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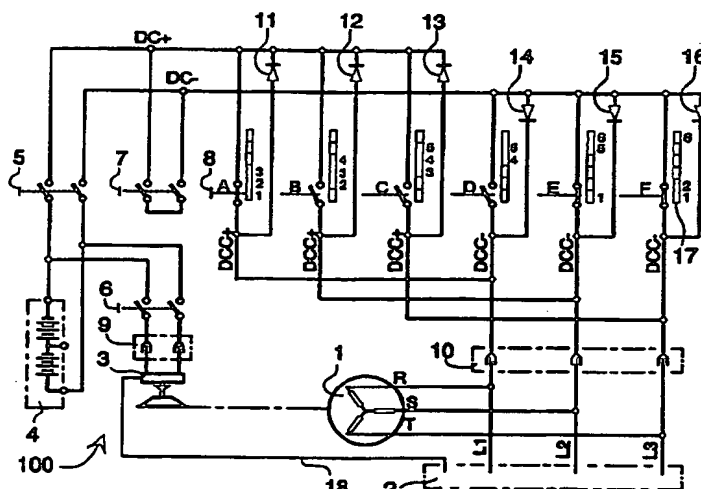


Fig. 1

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## EUROPEAN SEARCH REPORT

Application Number  
EP 96 10 4741

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,X	US 4 376 471 A (UCHINO HIDEO ET AL) 15 March 1983 * column 4, line 46 - line 55 * * figures 2,4,6 *	1-4,7	B66B5/02
Y	---	5	
Y	PATENT ABSTRACTS OF JAPAN vol. 014, no. 113 (M-0944), 2 March 1990 & JP 01 313283 A (TOSHIBA CORP), 18 December 1989, * abstract *	5	
A	---	1	
A	EP 0 248 754 A (ORTIGOSA GARCIA JUAN) 9 December 1987 * column 4, line 9 - column 6, line 53 * * figure 1 *	1-3,7	
A	---		
A	US 4 024 455 A (YARROW CHRISTOPHER JOHN ET AL) 17 May 1977 * abstract * * figure 3 *	1	
A	---		
A	DATABASE WPI Section PQ, Week 9524 Derwent Publications Ltd., London, GB; Class Q38, AN 95-179505 XP002039050 & CN 1 083 017 A (XINKAI GEN PILOT FACTORY XICHENG DISTRIC) , 2 March 1994 * abstract *	6	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27 August 1997	Examiner Salvador, D
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

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